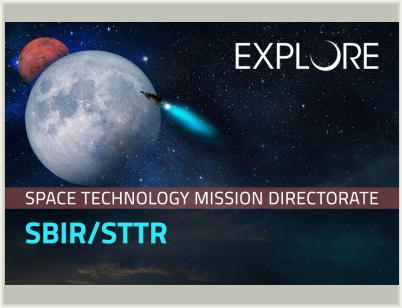
Efficient Space Hardy Thermoelectric Materials with Broad Temperature Range, Phase II

Completed Technology Project (2009 - 2011)

Project Introduction

The goal of this work is to develop new thermoelectric materials for use in fabricating solid state cooling devices and electrical power generators, which are 200 to 300% more efficient than current thermoelectric materials and can operate in temperatures ranging from cryogenic to 700 C. The results of our Phase I definitely indicate that we will be able to reach this goal. These materials are being made from new nano-composites, using fabrication techniques developed at Eltron. The thermoelectric composite's matrix had already demonstrated exceptional ability for functioning in the environment of space. Used in a cooling system, these materials will provide an effective means for controlling the temperature of surfaces subject to the rapidly changing temperatures encountered in space. We have proven that this matrix works exceptionally well at providing support and allowing for convenient (and therefore economical) deposition of our materials. We have also demonstrated that the thermal conductivity in these new nano-materials has been reduced by well over an order of magnitude! In addition we have shown that we get an increase in the Seebeck Coefficient for materials we tested as well. These new thermoelectric materials can be used to prevent development of large temperature gradients and thereby prevent the mechanical stresses that accompany them. Used for power-generation, these new materials will be very efficient because of the properties that both the nano-phase materials and its matrix bring to the thermoelectric material. Because of the difficulties presented in the harsh environment of space, thermal management and power generation is most easily provided through devices that do not have any moving parts, are very durable, do not require maintenance, and operate efficiently over a wide range of temperatures. The proposed materials meet all these requirements.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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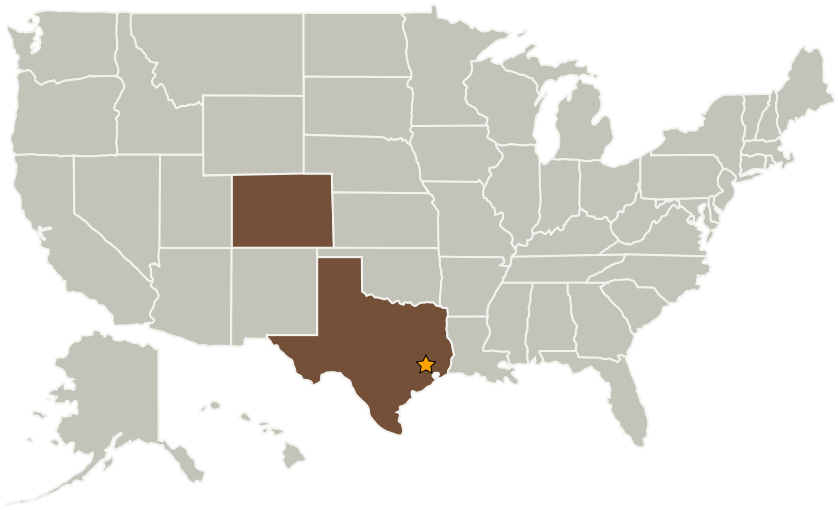
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Eltron Research & Development, Inc.	Supporting Organization	Industry	Boulder, Colorado

Primary U.S. Work Locations	
Colorado	Texas

Project Transitions

March 2009: Project Start

March 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines